

Described from a single example taken by Mr. Bell-Marley at Krantzkloof, Natal, July 1910.

*Platynus (Anchomenus) zuluuanus*, sp. n.

Length  $7\frac{1}{2}$ –8 mm.; width  $2\frac{3}{4}$ –3 mm.

Head, prothorax, labrum, and mandibles piceous red, the head a shade darker than the other parts; first three and tips of ultimate joints of antennæ, palpi, and legs light testaceous brown, the remaining joints of antennæ, annulets on terminal joints of palpi, the femora about knees, the tibiæ above, and tarsi at apices of joints infuscated or more deeply browned. Elytra greenish black, ænescent, very shiny, outer margins and beneath rufo-testaceous.

*Head* smooth, frons shallowly grooved on either side above epistome.

*Prothorax* narrow, as long as wide, much narrower in the posterior than in the anterior parts, apical angles declivous, prominent, moderately sharp, sides reflex-margined, gently amplified to about middle, thence sinuately narrowed to the basal angles, which are somewhat obtuse and recurved, disc smooth or hardly perceptibly aciculate, a little convex medially, lateral basal sulci elongate and parallel to margins, median groove deep reaching from apex to a little above base.

*Elytra* at base nearly twice as wide as prothorax, shoulders rounded, sides (male) very slightly, (female) a trifle more amplified, broadly rounded to and a little sinuated before apices, very finely striate, intervals plane and smooth, seriate punctures on third intervals very faint, one near base impinging on the fourth stria, a second a little postmedian, and two others near together on the apical declivity.

In the narrowness of the elytra, not in its contour, it approximates to *P. alacer*, but in its less elongate legs and other characteristics it is far removed from that species. Of the South-African species known to me its nearest allies are *P. letulus*, Pér., and *P. fallaciosus*, Pér.

III.—Some new Species of Earthworms belonging to the Genus *Glyphidrilus*. By C. R. NARAYAN RAO, M.A., University of Mysore, Bangalore.

ACCORDING to the published records, the following species represent the family Glossoscolecidae in India: *Pontoscolex corethrurus*, *Criodrilus lacuum*, *C. bathybates*, *Glyphidrilus annandalei*, and *G. tuberosus*. This paper discusses four

new examples assigned to the genus *Glyphidrilus*, mainly from Coorg and Shimoga (Mysore). Through the courtesy of the Director of the Zoological Survey of India, I was enabled to examine in June 1918 the above forms belonging to the Indian Museum, and more recently I was given the opportunity of re-comparing the examples of *Glyphidrilus* with my own material. I am thankful to the Museum authorities.

The two new species, *G. rarus* and *G. saffronensis*, of which there are a large number of sexually mature forms in the collection, are without a trace of clitellum, puberty-tubercles, and latero-ventral wing-like expansions or ridges of the body-wall. Besides, the seta-distances and the size of the setæ vary to an extraordinary degree in the four species, and I am of opinion that these characters, which are associated very largely with growth and sexual maturity, cannot be relied upon as a very safe diagnostic feature. In a few important particulars the generic characters of *Glyphidrilus* have to be recast and written thus:—

#### Genus GLYPHIDRILUS, Horst.

1900. Michaelsen, "Oligochæta" in 'Das Tierreich,' p. 459.

Prostomium pro- or zygo-lobous. The first 12–22 somites are circular in cross-section, hard and large; the body behind is four-cornered (in preserved specimens). Anus dorsal and large, surrounded by a few extremely short segments and a variable number of them in front also, are marked off from the rest of the body by their shortness. Setæ on the middle of body are invariably larger; the seta-distance  $dd = < \text{or} > aa$ . The clitellum, if present, is marked by the possession of puberty-tubercles and latero-ventral ridges or wing-like expansions of the body-wall. These, together with the clitellum, may be absent. The position of male aperture varies, is not easily made out, and is placed as a rule within the clitellum. The spermathecal pores, either single or groups, occur in front of the male aperture, in the intersegmental furrows from two to six somites within the seta-space  $bc$ . A well-developed gizzard in front of septum 8–9 occupying segment 8 or  $7\frac{1}{2}$ , 8 and  $9\frac{1}{2}$ . Calciferous glands absent; œsophageal pouches in somites 9 and 10 may or may not be present. Two pairs of testes and funnels in somites 10–11, and usually four pairs of seminal vesicles in segments 9–12. A pair of ovaries and ovisacs in segment 13.

Twelve species are now known, of which six occur in India. Found in close proximity of fresh water.

The Indian examples may be recognized on the basis of the following characters:—

1. Clitellum segments 17, 18-36, 41; latero-ventral ridge or wing-segments 27, 29-32, 33; puberty-tubercles three rows in front of the ridge; gizzard segment 8, slightly extending into 7 ..... *G. annandalei*, Mich.
2. Clitellum segments 14, 15, 16-28, 30; latero-ventral ridge segments 20-23, 24; the ridge may be foliated into a cauliflower-like outgrowth; puberty-tubercles in three sets, an anterior on segments 10-12, a middle on 17, 18-19, and a posterior on 24-28; gizzard segment 7 extending into 8 .... *G. tuberosus*, Steph.
3. Clitellum segments 13, 14-35; latero-ventral ridge segment 25-32, 32½; puberty-tubercles three rows in front of ridge; gizzard segment 8 extending into anterior half of segment 9 ..... *G. fluviatilis*, Rao.
4. Clitellum segments 14-35, 48; latero-ventral ridge segments 24-32, 36, and may be occasionally repeated on segments 40-45 on one or both sides; puberty-tubercles three or only two rows in front of ridge; gizzard segment 8 ..... *G. elegans*, Rao.
5. No clitellum; no puberty-tubercles; no latero-ventral ridge, or a feebly-marked one between seta-line *bc*; segment on the middle of body as large as or larger than segments 7-12; gizzard spherical, segment 8; no oesophageal pouches ..... *G. rarus*, Rao.
6. No clitellum; no puberty-tubercles, no latero-ventral ridge; segments on the middle of body considerably less than half the width of segments 7-12; gizzard cylindrical in segments 7½-9½; oesophageal pouches in segments 9-10 ..... *G. saffronensis*, Rao.

*Glyphidrilus fluviatilis*, sp. n.

There are more than forty large and sexually mature specimens in the collection, with the median row of puberty-tubercles ranging from 3 to 14, and their mode of occurrence is very arbitrary.

*External characters.*—The longest specimens measure 270-275 mm.; circumference in the preclitellar region 4½ mm.; width in the region of puberty-tubercles 5½ mm.; across the clitellar wing 1 mm.; postclitellar region 4 mm.

The anterior part of the body down to segment 16, 18 is round, and behind it is four-cornered; the terminal part of the body may be swollen or narrowed into a cone. The

part of the body which is quadrilateral in cross-section bears dorsal and ventral wide and lateral, sometimes deep canals. Total number of segments 270-385. The pre-clitellar segments, nearly twice the size of the postclitellar ones, bear a number of prominent secondary annular ridges and grooves. The clitellar segments with the latero-ventral wings are the broadest and soft, bearing ventrally irregular grooves and ridges. The number of segments surrounding the anus can hardly be counted, owing to extreme shortness.

Anus a large longitudinal slit, dorsal in position, borne on a swollen cone or on the unmodified posterior region. Prostomium pro- or zygo-lobous.

Fig. 1.



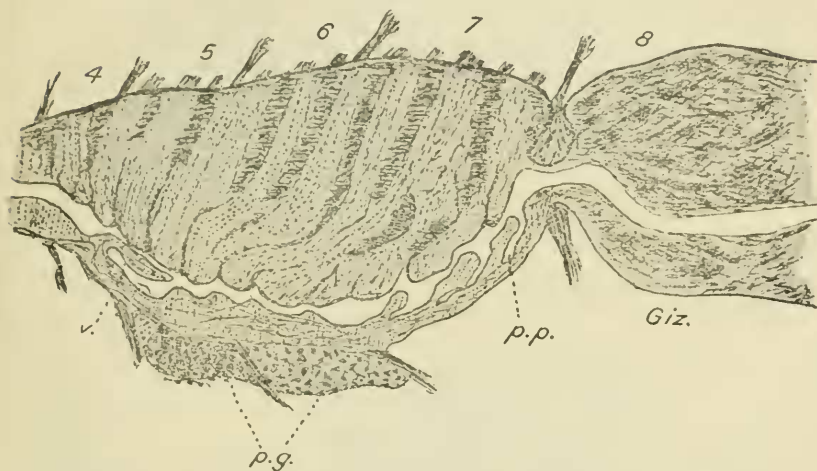
A seta (*b*) from the middle of body of *Glyphidrilus fluviatilis*,  $\times 75$ .

Dorsal pores absent.

In the preclitellar region the seta-distance is *aa*, equal to or slightly less than *bc* or *dd*;  $bc = dd$ ;  $ab = cd$ . In the post-clitellar region  $aa : ab : bc : cd : dd = 2 : \frac{1}{2} : 1 : \frac{1}{2} : 1\frac{1}{2}$  or 2. A seta from the preclitellar region measures nearly 0.75 mm. long and 0.12 broad. The skin is raised in a tent-like fashion over the seta in the middle and hinder part of body. The projecting part of the setæ is ornamented by delicate annulations, and the stem embedded in the follicle bears a few irregularly-disposed spines, and the whole structure is marked by fine striations, the distance between any two striae being 1150  $\mu$ . The first segment is free.

Traces of clitellum begin on segment 13, but become strongly marked on segments 14-33, 36 (=23 somites). The clitellar somites 25-32½ bear latero-ventral wing-like expansions with either a straight or greatly-folded margin. The limits of the clitellum at either end are indistinct. The

Fig. 2.



Vertical longitudinal section of pharynx and gizzard of *G. fluviatilis*. The section shows the immense dorsal thickening of the pharyngeal wall, the ventral thrown into folds so as to give rise to pouch-like sacs.

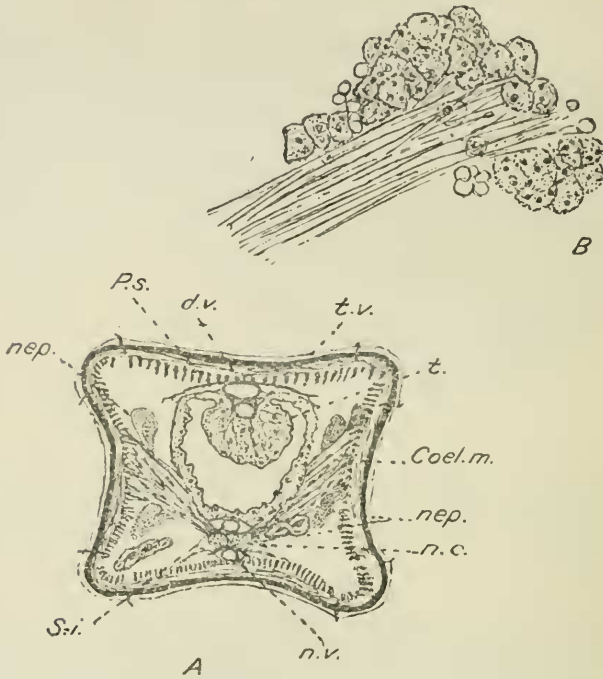
Lettering to figs. 2-4.

*amp.c.* = ampulliform clitellar cells; *b.v.* = blood-vessel; *Coel.m.* = coelomic muscles with clumps of cells on them; *c.t.* = connective tissue; *d.v.* = dorsal vessel; *g.c.* = glandular cells; *Giz.* = gizzard; *m.* = muscular system of body-wall; *nep.* = nephridia; *nep.c.* = nephridial cells, showing the characteristic form and position of nucleus; *n.c.* = nerve-cord; *n.v.* = subneural vessel; *nip.* = tent of puberty-tubercle; *ob.m.* = oblique muscle-fibres; *p.g.* = pharyngeal gland; *p.p.* = pharyngeal pouch; *p.s.* = peritoneal sheath; *r.* = rim of puberty-tubercle; *ring.m.* = circular muscles of the rim; *s.* = skin; *s.i.* = subintestinal vessel; *t.* = typhlosole; *t.v.* = typhlosolar vessel; *v.* = valve-like fold of pharynx; *w.t.* = wide tube free in fig. 4 B and clogged by degenerate nephridial cells in fig. 4 C; *n.t.* = narrow tube free in fig. 4 B and clogged by degenerate nephridial cells in fig. 4 C.

puberty-tubercles occur in three rows in front of the clitellar fold, and their number and relation to somites are irregular. The mid-ventral row commences on segments 13, 16, extending up to segments 23, 24. The number of lateral papillæ

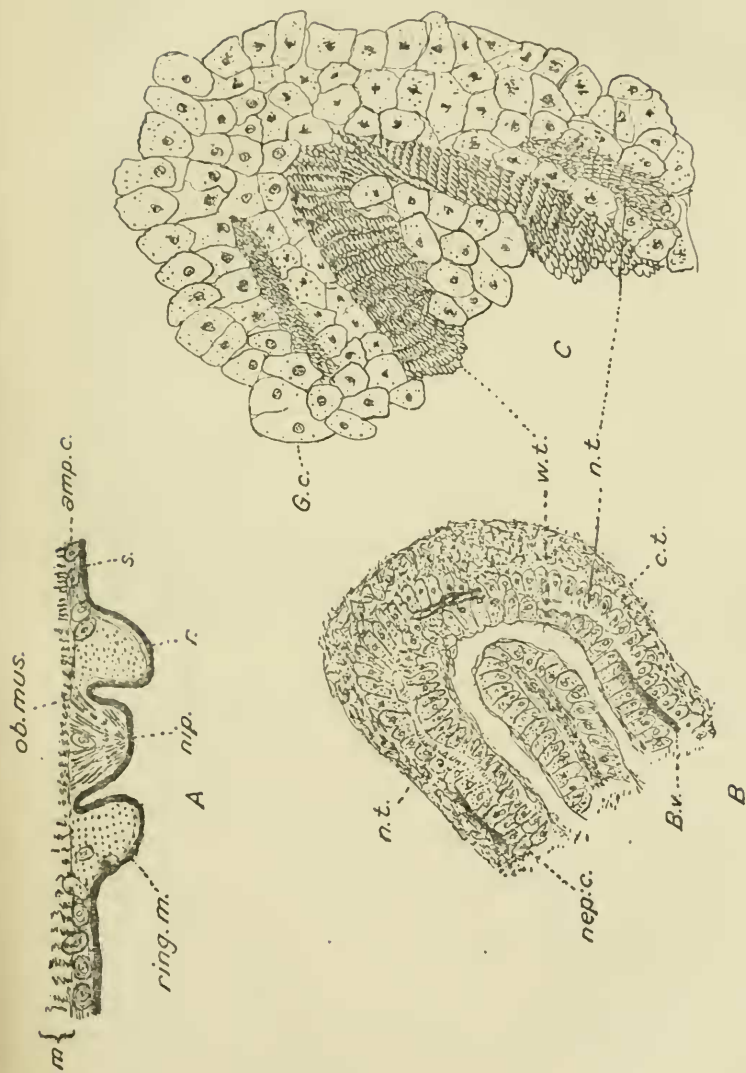
is fairly constant, the first occurring on the somite 14, though there may be lop-sided individual variations. Behind the clitellar wing segments 33-35 bear lateral tubercles, and median ones occur on segments 38-40. The disposition of the lateral papillæ is interesting: the first three on either

Fig. 3.



- A. Transverse section of the middle of body of *G. fluviatilis*, to show the relation of the coelomic muscles and the viscera. In the ventral coelomic chamber lie the nephridia, nerve-cord, and the subintestinal and subneural vessels.
- B. Stained preparation of the coelomic muscles, showing the clumps of cells and corpuscles of the coelomic fluid. The double and tri-nuclear nature of the cells is clearly seen.

side are in seta-line *bc*, 4 and 5 are shifted dorsalwards lying in seta-line *cd*, and the series from the sixth is again shifted to seta-line *cd*. Each tubercle is placed on the posterior margin of the somite to which it belongs, and may be so large that the tubercles form a continuous row. Each



papilla consists of a circular elevated ridge with a central nipple, separated from the former by a deep moat all round. Occasionally there may be two such nipples on a papilla, when it becomes quadrilateral in outline. If, as occasionally happens, the papillary somites should bear secondary annular ridges, these latter become conspicuous bars connecting the three rows of tubercles on the somite, which in cross-section is more like a segment of a circle. In sectional preparations (fig. 4, A), the tubercle is seen to be composed of circular muscle-fibres in the outer rim, and in the central nipple occur an outermost circular layer and an inner band of vertical muscles, which converge towards the apex in an oblique manner from all round the neighbourhood of the outer rim. There are no sensory cells of any kind on them, and only a few large oval glandular cells, occurring chiefly in the trench. Judged from their structure, there can be little doubt that the tubercles act as organs of adhesion in a sexual act, and when we consider the fact that the surroundings in which these worms live are likely to be suddenly inundated, the need for suctorial organs of some sort becomes all the greater. The lateral clitellar wings are muscular structures with the outer transverse and the inner longitudinal bands studded with the oval ampulliform gland-cells. Lying in between the muscle-bands of both sets are to be found branching connecting-tissue fibres, which enable these flaps of skin to be stretched out fairly widely.

No genital pores can be made out, except in sections. Spermathecal apertures occur in intersegmental furrows. Male orifice in the intersegmental furrow 21/22 nearer to seta-line *b*.

Opening of the oviduct segment 13 between seta-space *aa*. Nephridial pores large between *bc*, very well marked behind segment 12, and inconspicuous anteriorly.

*Colour*.—In spirit-specimens the colour is a dark grey, with occasionally traces of orange on the anterior part of the body. In the live specimens the greater part of the postclitellar region is yellow with a dark, broad, dorsal and frequently ventral band. The whole clitellar portion is grey or even white, and the body in front is yellowish red.

*Internal organisation*.—The first recognisable septum 3/4 is composed of a few muscle-bands only, 4/5 better developed. Septum 5/6 is only slightly and 6/7-14/15 very thick. Others are tender.

Dorsally the pharyngeal muscles are densely developed, arising from the posterior border of septa 4/5-7/8, and



inserted obliquely forwards. They form a dense matting over the pharynx. Ventrally the bands are separate and more strongly developed. The pharynx (fig. 2) occupies somites 3-7. Its dorsal wall is enormously developed, and tongues of muscles dip into the cavity and almost fit into corresponding depressions on the floor. The ventral wall at the level of the fourth segment is raised into a semilunar valve-like fold, whose presence is marked outside by an intucking of the wall. The ventral wall of the pharynx in somites 6 and 7 is raised into vertical folds, simulating the pouch. The nephridia of segments 5-6 are all fused together to form a single median structure, closely applied to the ventral wall of the pharynx. They are modified into flat glandular bodies, in which the small nephridial cells are united to become large polygonal syncytial cells in the main lobes. They have no nephridiopores, and just behind the semilunar fold (segment 4) is a small aperture, which can be traced to these pharyngeal glands; in a series of sections the communicating channels lie closely adherent to the under surface of the pharyngeal wall. The gizzard is in segment 8, slightly extending into segment 9. The intestine commences in segment 14. There is a typhlosole.

Below the dorsal vessel lies a typhlosolar vessel, which runs up to the genital somites, where it attains the thickness of the superior vessel, finally entering the pharynx. The last heart is in segment 12. There are subintestinal and sub-neural vessels. A lateral vessel is present only occasionally. The secondary segmental sheath, in which the dorsal vessel is enclosed in segments 18-25, is a flat somewhat loose pouch filled with cœlomoocytes and blood-corpuseles. I have not been able to make out any communication between these pockets and the body-cavity.

The nephridial system consists of a series of very large meganephridia, becoming most conspicuous from somites 14. In front they are only feebly developed—sometimes disposed in the form of arches over the alimentary canal, or are tucked under in the form of tufts. The nephrostomes are large club-shaped structures, in which the diameter of the ciliated funnel is only slightly wider than the funnel-tube. In segments 24-32, of the majority of examples dissected and examined, are found small vesicles, not unlike the spermatheca in the anterior somites, in close relation with the nephridia of these segments. The vesicles, which are 3-4, lie in the seta-line *a*, *b*, *c*, *d* on either side close to the posterior surface of septa, and are connected with the main lobes of the nephridia only by muscular attachments.

Apparently they have no ductules leading them to the outside world, for none can be made out in sections. In respect of microscopic structure, their excessively thin wall is composed of cubical large cells and a few muscle-fibres circularly disposed. The vesicles were empty. They must be degenerate spermathecae, unusually placed far behind.

The male organs comprise four pairs of large testicular sacs in segments 9-12. Each vesicle is a greatly lobulated, pyriform, spherical or oval organ, the anterior two are attached to the hearts in whose loop they lie just in front of septa 9/10 and 10/11, and the hinder two are attached to the posterior face of septa 10/11 and 11/12. I have noticed, in about three out of eight examples dissected, a fifth pair of seminal vesicles attached to the anterior surface of septum 11/12. Seminal funnels are large, placed in segments 9 and 10-11 attached to the sacs. Testes are small brush-like organs, mostly free, attached to about middle of the anterior surface of septa 9/10 and 10/11. There are no prostates. The male aperture could be made out only in sectional preparations in the intersegmental furrow 21/22 nearer to seta-line *b*.

There is a single pair of large spermathecae in segment 14. Each is a stalked pyriform organ without diverticula. The duct enters the posterior face of septum 13/14. In addition, there may be a variable number of spermathecae on each side, behind segment 14 in the seta-lines *a*, *b*, and *c* close to the posterior surface of septa 14/15, 15/16, 16/17. They are sessile, almost buried in the thickness of the body-wall. Each of these structures differs from the ampulla referred to in connection with the nephridia by the muscle-fibres forming distinct spiral bands. In vertical sections of the body-wall in this region the apertures are made out. Asymmetrically situated behind segment 16 are occasional spermathecal vesicles, either only on one or both sides.

The ovary and ovisacs are large, more or less spherical, soft, lobulated bodies, in segment 13 attached to the posterior surface of septum 12/13. No oviduct was made out. Female pore on segment 13 within the seta-space *aa*.

*Locality*.—Sandy banks of Rivers Harangi, Madapur (Coorg); Cauvery, Fraserpett (Coorg), and Sheravathy, Shimoga (Mysore).

Type-specimen in the British Museum.

Syntypes in the Hamburg and Indian Museums.

*Remarks*.—This species and the three others described in this paper do not in the living condition possess a four-cornered body behind segments 12 or 13, but nearly a flat

oval one. It is while fixing the animals that the body becomes four-cornered, and in the struggles snaps occur at different parts, leading to complete separation. The quadrilateral nature of the body is produced by the sudden contractions of the transverse bands of coelomic muscles, which extend from seta-space *bc* to below the intestine. These muscles (fig. 3, A & B), which start from the body-wall in the median line, spread outwards in the form of a cone on either side, and a pull on the body-wall on the sides accounts for the lateral canals and dorsal and ventral corners. The contraction of the vertical muscles of the septa, which extend beyond the grooves on either side of the body-wall, would produce the dorsal and ventral canals. The secondary sets of coelomic muscle-bundles do not occur in front of the segment 14, and hence this region remains round.

But the most interesting fact connected with these muscles is that they almost form, being connected here and there in their course by patches of peritoneal membrane, secondary ventral chambers, in which the nephridia are lodged. They have to be disengaged from these chambers for a more detailed examination. Numerous bubbles of air escape from these secondary chambers, as in other freshwater species, while the worms are opened and spread out, and, where the pressure has not ruptured the investing membrane of the ventral coelomic chamber, very large air-bubbles are noticed, being entangled within the muscular mesh. Such air-bubbles are found throughout the worm. The chamber on one side communicates with its fellow on the opposite side below the intestine and the nerve-cord, the associated vessels and the nephridia lie within the secondary cavity. In cross-section the chambers look like two cones, their apices meeting in the middle. The upper wall is composed of several bands of muscles, held together imperfectly in most places by the reflected portion of the peritoneum from the intestine. On the body-wall (*bc*) the bundles of muscles at their point of insertion spread out in the form of a fan. Occurring in the narrower middle portion of the chamber, and also in the outward part, are clumps of large polygonal cells with one or more deeply staining nuclei associated with the muscle-bundles. Mixed up with these clumps are coelomocytes and a fine plexus of blood-capillaries. In any teased and stained preparation of the muscle-fibres, the cell-clumps are a striking feature, and occur uniformly. I am unable to trace the source or determine at present the nature of the origin of these cells, which may be due perhaps to the proliferation of peritoneal cells, which

they resemble closely except in size. In view of the absence of the dorsal pores, and consequently the complete shutting off of the segmental cavities from the outside world, it is only reasonable to associate in some sort of manner the uniform occurrence of the bubbles with the cell-aggregates of the secondary chambers. In other words, the ventral portion of the coelomic cavity perhaps acts as a hydrostatic chamber, which in worms whose environment is susceptible of being frequently inundated by sudden floods must be extremely of a useful character.

*Glyphidrilus elegans*, sp. n.

*External characters.*—The largest specimens measure 136 mm.; number of segments 186–270; circumference of body about segments 9–14  $3\frac{1}{2}$  mm. where the body is round; from segments 18–24 5 mm. across the body where it is flat; between the inner borders of the clitellar wing 5.5 mm., here the body is thick and flat. Behind the body gradually narrows and is four-cornered, with the dorsal, ventral, and lateral canals. Sometimes the dorsal depression may extend forward up to segment 13; segments 7–13 are broad and those behind are extremely short, nearly half or less than half of the anterior ones. Segments in the posterior part of the body only gradually become short and can be counted up to the anus, which is dorsal and terminal. The anterior preclitellar segments have secondary annular ridges and grooves.

Prostomium zygalobous.

Dorsal pores absent. Nephridial pores from behind segment 12 in seta-space *bc*.

In segments 24–32  $aa=2\frac{1}{2}ab$  and  $=2ab$  both in front and behind this region, and gradually becoming less than  $2ab$  both ways;  $aa$  is greater than  $bc$  or  $dd$ ;  $ab=cd$ .

The clitellum is marked from segments 14–35, 48 (=22–35).

The genital markings are three, or only two rows of puberty-tubercles. The median, when present, commences from segments 12–13, and quite variable in number (7, 12), and the laterals, which are uniform in their occurrence, begin on segment 13 extending up to segment 24. Behind the puberty-wing, the lateral series may be continued on segments 32–36 on one or both sides and the median ones on segments 41–42. Each of these tubercles, which in point of disposition and microscopical structure resembles the foregoing species, differs from them in a marked manner by their oval or transversely elongated shape. The secondary annular ridges from segments 18, 22 are very strongly

developed on the ventral surface, and connecting the three tubercles on a segment constitute a characteristic feature. Each tubercle occupies the whole width of the segment, and consequently touches one another so as to form a continuous structure. In the case of the lateral tubercles from segments 12-24, there is a clitellar ridge, dorsal to the tubercles and becoming continuous with the broader wing from segments 25-32, 36, and occasionally repeated on one or both sides on segments 40-45. The border is greatly foliated. No genital pores can be made out except in sections.

*Colour.*—In the living condition this is a beautiful worm, covered by more than one vivid colour. The anterior part of the body down to segment 18 is bright orange, and from behind down to about segment 40 it is a warm yellow. Dark dorsal and ventral bands occur. The yellow posterior part of the body becomes rather dirty. The mid-clitellar region is deeply red, while the tubercles and the wing are white. In the spirit-specimens the yellow and even the red may be preserved in varying degrees.

*Internal organisation.*—Septum 6/7 moderately and 7/8-10/11 very thick. Septum 4/5 is the first recognizable one.

The pharynx extends up to segment 6½ and is thrown into pouch-like sacs in segment 7. Gizzard spherical, very large in segment 8. Intestine begins in segment 14. A typhlosole is present. Pharyngeal glands present, having the same relation and structure as those of the previous species.

Dorsal vessel single. Last heart in segment 11 and an additional one frequently in segment 12.

Meganephridia commencing from segment 12. None in front. They are enclosed in the ventral secondary coelomic chambers.

*Male organs.*—There are four pairs of seminal vesicles in segments 9-12, those in 9, 10, and 12 being conspicuous. They are directly attached in the usual way to the anterior and posterior surfaces on septa 9/10, 10/11, 10/11, and 11/12 respectively. The vesicles are irregularly spherical bodies, soft and lobulated. No prostates.

Testes and funnels in segments 10-11 both conspicuous and easily made out. Male aperture in intersegmental furrow 27/28 on seta-line *b*.

Ovisacs and ovaries situated in segment 13 on the dorsal vessel, each is a large flat body, loosely attached to the posterior surface of septum 12/13. Oviducts not identifiable. Female orifice segment 13 within *aa*.

Spermathecae are situated in segments 13-16. They are

minute, sessile, subspherical bodies embedded in the body-wall. In each segment there are five on each side, the innermost row internal to seta-line *aa*, and the others on seta-lines *a*, *b*, *c*, *d*, with corresponding intersegmental spermathecal apertures. Lop-sided variations in regard to the spermathecae are common, the additional ones occur in segments 17-18 in the seta-line *b*. The supra-oesophageal ganglion occurs in segment 4.

Type-specimen in the British Museum.

Syntypes in the Hamburg and Indian Museums.

*Locality*.—Sandy islets in the Cauvery, Dubari forests. Fraserpett (Coorg); banks of Sheravaty, Shimoga (Mysore).

*Glyphidrilus varus*, sp. n.

*External characters*.—Average length of three longest specimens 205 mm.; maximum thickness 4 mm., which may increase slightly behind or suddenly fall from behind segments 9-12. The last segments 20-32, immediately in front of anus, become very short, and are marked off from the rest of the body in front. Average number of segments 290; segments 6-10 large; those in the middle of the body equal to these or only very slightly shorter. The number surrounding the anus is too short to be counted. Body round for about twelve segments, behind it is high and four-cornered, with broad dorsal, ventral, and lateral canals; segments 3-14 bear secondary ridges and annulations.

Prostomium large, zygalobous. Mouth is a crescentic opening, rather ventral. Anus a narrow longitudinal slit, dorsal in position.

Dorsal pores none.

The seta-distance in front of segment 12 is  $aa=2$ ,  $ab=1$ ,  $bc=1\frac{1}{2}$ ,  $cd=1\frac{1}{2}$ ,  $dd=2$ ; in the middle of body  $aa=2\frac{3}{4}$ ,  $ab=1\frac{1}{2}$ ,  $bc=1\frac{1}{2}$ ,  $cd=1$ ,  $dd=2\frac{3}{4}$ ; in the terminal modified portion of body  $aa=1\frac{3}{4}$ ,  $ab=\frac{3}{4}$ ,  $bc=1$ ,  $cd=\frac{3}{4}$ ,  $dd=1\frac{3}{4}$ . The first segment is free. Setae on middle of body very large.

No trace of clitellum, although all the numerous specimens in the collection are fully mature and the sexual glands are well developed. Puberty-tubercles and clitellar wing-like expansions are also absent. The latter may be feebly formed over somites 25-32 on the outer side of seta-line *b*.

Nephridial pores in the intersegmental furrows in the middle of seta-space *bc* throughout the length of body from segment 12.

None of the spermathecal apertures can be made out

easily, except in sections in the intersegmental furrows 13/14, 15/16 on seta-line *b*. Male and female apertures cannot be identified.

*Colour.*—In the live specimens the whole body is a pale grey, or even slightly brownish in some, with the usual dark dorsal and ventral bands. There is no colour-change in the preserved material.

*Internal organisation.*—The first recognisable septum is 4/5; septa 7/8–10/11 very thick, those of 11/12–14/15 fairly thick. Those of 4/5–6/7 are thicker than 16/17.

The pharyngeal muscles are very strongly developed in somites 6–7, though the ventral bands are few. The pharynx is a spherical, strongly muscular chamber occupying somites 3–6. Pharyngeal wall in segment 7 thrown into pouches. A well-developed spherical gizzard in segment 8. An œsophageal pouch may be present in segment 9. The intestine begins in segment 13, and in 14 the intestinal wall is thick, white, and spherical, so as to simulate a secondary posterior gizzard. There is a typhlosole, but no pharyngeal glands.

The dorsal vessel is a stout tube of uniform thickness throughout. There is a typhlosolar vessel which comes to the surface of the intestine at the level of segment 14, and is continued forwards in the form of an independent vessel entering the pharynx anteriorly. The last heart is in segment 11. A lateral longitudinal vessel, about the thickness of the dorsal vessel, extends from the anterior end backwards in seta-line *b*. It is suddenly deflected inwards at about the level of somite 13, or may be continued in the same seta-line as far behind as segments 46–60, becoming greatly attenuated in its course. There is only a sub-intestinal vessel.

The nephridia begin in segments 14–15.

*Male organs.*—The testes and funnel in segment 10 not identifiable, but made out in segment 11. There are four pairs of seminal vesicles, irregular in shape and independent of the loops of the heart. The anterior ones are attached to the anterior face of septa 10/11 and 11/12. There are no prostates. Male aperture in the intersegmental furrow 21/22 on seta-line *b*.

A small ovary and an egg-sac are attached to the posterior surface of the septum 12/13 dorsal in position. No oviduct. Female orifice on segment 13 within *aa*.

No spermatheca could be discovered in any of the three specimens dissected. In one, however, a small whitish pear-shaped organ occurred in seta-line *b*, segments 14, 15 on

both sides perhaps representing rudimentary spermathecal structures.

Type-specimen in the British Museum.

Syntypes in the Hamburg and Indian Museums.

*Locality*.—Sandy banks of the Harangi, Madapur (Coorg), and of the Cauvery, Dubari forests, Fraserpett (Coorg).

*Glyphidrilus saffronensis*, sp. n.

*External characters*.—Average length of three longest specimens 135 mm.; maximum thickness 5 mm., which is fairly the thickness throughout, except the posterior one-eighth, which gradually tapers towards the anus. Average number of segments 298. Segments in the middle of body about one-third the width of segments 6–12, and those immediately in front of the anus about half the width of former.

Anteriorly the body is round, behind it becomes four-cornered with feebly lateral canals, the dorsal and ventral ones, however, are strongly marked. Secondary annular ridges may be wanting or may be limited to the occurrence of one on each segment, mainly anteriorly.

Prostomium large, zygalobous. In the preserved specimens the anterior dorsal wall of the pharynx may project beyond the mouth. No dorsal pores. Anus, a dorsal longitudinal slit, wider at the terminal part with tumid lips.

The seta-distance in front of segment 12  $aa=1\frac{1}{2}$ ,  $ab=1$ ,  $bc=1\frac{1}{2}$ ,  $cd=1$ ,  $dd=1\frac{1}{2}$ ; in the middle of body  $aa=2$ ,  $ab=.75$ ,  $bc=1\frac{1}{2}$ ,  $cd=.75$ ,  $dd=2$ ; in the terminal modified portion of body  $aa=1$ ,  $ab=.50$ ,  $bc=.75$ ,  $cd=.50$ ,  $dd=1$ .

No trace of clitellum, all the numerous examples in the collection being sexually mature; puberty-tubercles and clitellar wing absent.

Nephridial pores, in the intersegmental furrows, nearer to seta-line *c* throughout the length of body from segment 18.

Spermathecal apertures made out with difficulty in the intersegmental furrows 13/14–16/17 nearer to seta-line *b*. Sometimes only one orifice, that of 13/14 may be present. Male aperture on the intersegmental furrow 27/28 in the seta-space *ab*; female opening not discoverable.

*Colour*.—In the living condition the whole body is a vivid lemon-yellow, with reddish and whitish patches on the anterior somites. The terminal modified portion of body white. Dorsal and ventral dark bands. In the preserved specimens the colour is either a pale yellow or grey.

*Internal organisation*.—The first recognisable septum is 4/5, which and the succeeding two are strongly muscular.



Septa 7/8 and 10/11 are very thick and 11/12 only slightly so.

The oblique pharyngeal muscle-bands spring from the posterior margin of somite 7 ventrally, and pass inwards and forwards through septa 6/7 and 5/6 to be inserted into the ventral pharyngeal pit. The dorsal muscles form a closer matting structure, where the dorsal anterior wall of the pharynx is shot out, the whole pharynx appears on dissection a tubular structure, otherwise it is a spherical organ occupying somites 3-6.

The whole of the ventral wall of the pharynx is sacculated, becoming a distinct pouch in somite 7. The gizzard is very strongly developed; it is a long tubular structure, lying in somites  $7\frac{1}{2}$ , 8,  $9\frac{1}{2}$ , and accordingly septa 7/8 and 8/9 are displaced by the length of half a somite. Well-developed œsophageal pouches may occur in somites 9 and 10, the anterior being better developed. There is a typhlosole, the intestine beginning in segment 14. No salivary glands.

The last heart is in segment 11. A typhlosolar vessel and a lateral longitudinal vessel are present, the latter occasionally very feebly developed.

The nephridia commence in segments 12-13. Those in 13-16 are excessively large and are brownish in appearance. Frequently the nephridia may have a similar colour in one or more lobes. Structurally also there is modification. In the anterior nephridia (13-16) the lobes comprise very large oval cells, with deeply staining central nucleus. The protoplasm stains less easily. Clearing with glacial acetic acid reveals nothing, except that the protoplasm of the cells appears clearer and more granular. In sectional preparations, (fig. 4, B & C) the ordinary nephridial cells appear degenerate and block the system of draining-canals, the whole organ thus becoming a more solid structure with a rich plexus of blood-capillaries. There is little doubt that the larger cells are of secondary origin, though their source is doubtful. In none of the teased or sectional preparations of these modified nephridia could the occurrence of organic debris be found, the entire structure looking under the microscope not unlike that of an egg-sac. The exact nature of the function fulfilled by these greatly modified nephridia is problematical. The other nephridia in the middle of the body have the usual structure and disposition.

*Male organs.*—Two pairs of testes and two large seminal funnels in segments 9 and 10. The seminal vesicles, which are four, are unequally developed, and in point of attachment and position follow the usual rule (segments 9-12, the

first two attached independently of the hearts, to the anterior surface of septa 9/10 and 10/11, and the last two to the posterior face of septa 10/11 and 11/12). No prostates.

A pair of ovaries and ovisacs in segment 13 attached to the posterior surface of septum 12/13. No oviduct can be made out. Female opening, as made out in transverse sections, on segment 13 within seta-space *aa*.

Spermatheca not present.

The supra-oesophageal ganglion is in segment 4. The two halves of the nerve-cord remain separate, being enclosed only in a connective-tissue sheath.

Type in the British Museum.

Syntypes in the Hamburg and Indian Museums.

*Locality*.—Margins of pools in the forests of Dubari, Fraserpett (Coorg); river-beds of the Cauvery, Dubari (Coorg).

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IV.—*An Account of the Castniinæ in the Collection of Madame Gaston Fournier [Lepidoptera].* By PERCY I. LATHY, F.E.S.

[Plate IV.]

SINCE the appearance of M. Houlbert's fine work on the Castniinæ (Etud. Lépid. Comp. xv. 1918) the attention of Lepidopterists has naturally been turned towards this interesting family. Mr. Talbot, in his review of this work (Novitat. Zool. xxvi. pp. 28-35, 1919), and Lord Rothschild (*loc. cit.* pp. 1-27) have already added considerably to our